The Use of Artificial Intelligence in Singapore's Training and Adult Education Landscape

Bao Zhen Tan and Aggie Choo
Institute for Adult Learning, Singapore

Abstract

The training and adult education (TAE) landscape in Singapore is constantly developing, and the role of learning technologies in the context of continuing education and lifelong learning accelerated by COVID-19 is not yet well understood. Artificial intelligence (AI), particularly the recent boom of generative AI (e.g., ChatGPT) has also been used in innovative ways to personalize learning experiences for learners. The global market size of Artificial Intelligence (AI) has been increasing since 2021 and is forecasted to increase exponentially from nearly 100 billion U.S. dollars in 2021 to an estimation of nearly two trillion U.S. dollars in 2030 (Thormundsson, 2023). The adoption rate of AI is expected to rise rapidly, as recent advances in generative AI since the launch of ChatGPT in November 2022 has garnered unprecedented attention among educators and learners, among other professionals. However, there has also been a heated debate regarding the use of AI in education. Critics argued that AI can never fully replace the human element of teaching, and maintain the view that educators are essential for developing skills such as critical thinking and creativity, as well as empathy in the learners (e.g., Eynon, 2020). Others have raised concerns about data security and privacy. For example, the Facebook and Cambridge Analytica data scandal had raised concerns about privacy breach through the collection and analysis of data via AI systems (Chan, 2019). This paper investigates the use of AI in TAE as well as the perceptions of the use of AI in TAE among adult educators in Singapore. An online survey (n=624) was conducted from November to December 2023 among educators working in higher education or continuing adult education and training in Singapore – this includes all Institutes of Higher Learning, public and private educational institutions, as well as in-house training units. The survey consists of a series of Likert-scaled items that ask respondents to share their perspectives on the use of AI in TAE, their level confidence in the use AI in their TAE-related work, their perceived impact of the use of AI in TAE on their job and their learners, as well as their participation in professional development pertaining to the use of AI in TAE. To investigate the perceptions of AI among the adult educators, the survey adapted questions from an oft-researched theoretical model of user acceptance and usage of technology, called the Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989). Based in part on the Theory of Reasoned Action by Fishbein and Ajzen (1975), TAM in its original form suggests that an individual's motivation to use a technology is influenced by their perceived ease of use, perceived usefulness, and most significantly, the individual's attitude toward using the technology in question. The model posits that perceived ease of use directly influences both perceived usefulness and an individual's attitude towards the use of a technology. It is expected that the current usage of AI among the adult educators in Singapore will be low and limited to the use of generative AI to develop course content. A list of common AI tools currently used by the adult educators Singapore will be looked at and categorized based on their functions and usage. Using TAM and analyzing through Structural Equation Modelling, the determinants of an adult educator's intention to use AI in TAE will also be investigated. Findings from our analyses will have implications on the design of an AI tool. Other findings have general implications on the continuing professional development of the adult educators in Singapore pertaining to the use of AI in TAE, such as the preferred or ideal duration for relevant training courses.

Keywords: training, adult education, artificial intelligence, Technology Acceptance Model, technology

Introduction

Singapore's training and adult education (TAE) landscape is undergoing a period of dynamic transformation. While the importance of continuing education and lifelong learning has long been recognized, the COVID-19 pandemic has served as a significant catalyst. This period of disruption has accelerated the adoption of learning technologies, such as educational software and online platforms, thereby transforming the education landscape by offering new opportunities to enhance the quality and effectiveness of teaching and learning. The integration of technology in education has been met with both enthusiasm and skepticism, with some arguing that it has the potential to revolutionize education (e.g., Acemoglu et. al., 2014; Naik et. al., 2020), while others expressing concerns about the implications of relying too much on technology (e.g., Bauerlein, 2008; Selwyn, 2016).

This study's area of particular interest is in the use of Artificial Intelligence (AI) in TAE. The recent boom in generative AI, exemplified by tools like ChatGPT, has opened doors to personalized learning experiences. Learners can now benefit from tailored instruction and feedback, catering to their individual strengths and weaknesses. This trend aligns with the projected exponential growth of the global AI market, according to Thormundsson (2023). The market size is estimated to have nearly doubled from 2021 to 2030, reaching a projected value of nearly two trillion U.S. dollars. The recent advancements in generative AI, particularly since the launch of ChatGPT in November 2022, have fueled this rapid adoption rate. Educators and learners, alongside other professionals, have shown unprecedented levels of interest in the potential of AI to enhance the learning experience.

However, the use of AI in education is not without its critics. Concerns have been raised regarding its ability to fully replace the human element in teaching. Proponents of the human touch, like Eynon (2020), argue that educators are irreplaceable in fostering critical thinking, creativity, and empathy in their students. Additionally, data security and privacy remain key considerations. The Facebook-Cambridge Analytica data scandal, as discussed by Chan (2019), serves as a stark reminder of the potential for misuse of personal data collected and analyzed by AI systems. These concerns highlight the need for a balanced approach, where AI complements rather than replaces human educators, and where data privacy regulations are strictly enforced.

This paper aims to delve deeper into this evolving landscape. It will investigate the specific ways AI is being implemented within the Singaporean TAE sector. Additionally, it will explore the perceptions amongst adult educators using questions adapted from a theoretical model of user acceptance and usage of technology, called the Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989). Lastly, it looks into the impact of AI on the AEs' work, as well as the type of professional development activities the AEs have participated in to train in the use of AI in the context of TAE. The paper hypothesized the following:

> H1: Positive change in the adoption of AI and perception of AI
> H2: Positive relationship between perceived usefulness and perceived ease of use with attitude towards using AI

Methodology

An online survey was conducted in Singapore between October and November 2023. The survey included 1,000 adult educators (AEs) working across the higher education or continuing adult education and training sectors. This encompasses educators from all Institutes of Higher Learning, public and private educational institutions, as well as in-house training units. Their job function pertains to direct activities of development and training for adults, which may include one or more of the following: training/learning needs analysis, design and development of curriculum and/or

courseware materials, training/learning facilitation, assessment, consultancy and advisory services on learning solutions and interventions, etc.

The survey instrument utilized a series of Likert-scaled questions. These questions explored the AEs' perspectives on several key areas: their perspectives on the use of AI in TAE, their level of confidence in the use AI in their TAE-related work, their perceived impact of the use of AI in TAE on their job, as well as their participation in professional development pertaining to the use of AI in TAE. To gain deeper insights into educators' perceptions of AI, this study adapted questions from an oft-researched theoretical model of user acceptance and usage of technology, called the Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989). Based in part on the Theory of Reasoned Action (Fishbein & Ajzen, 1975), TAM in its original form suggests that an individual's motivation to use technology is influenced by their perceived ease of use, perceived usefulness, and most importantly, the individual user's attitude toward using the system in question. The model posits that perceived ease of use directly influences both perceived usefulness and also the individual user's attitude towards system use (Figure 1).

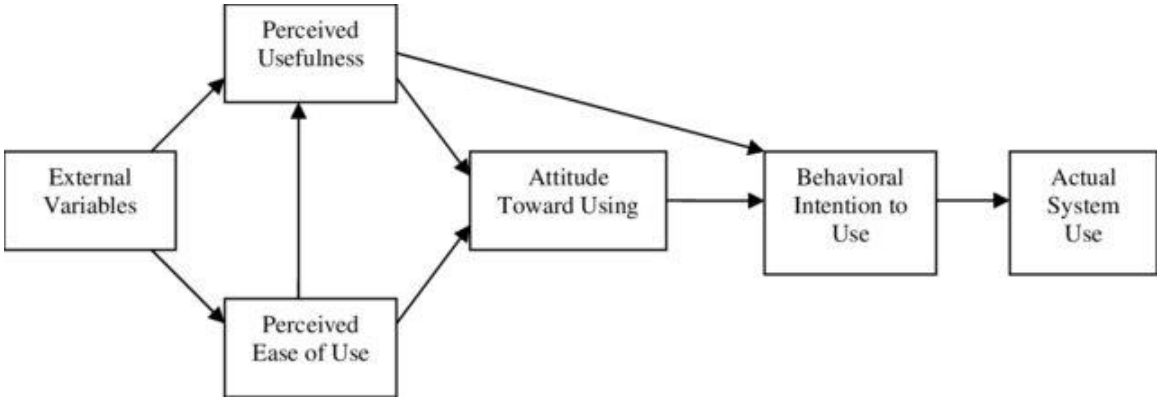

Figure 1 Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989)

The more recent TAM2 (Venkatesh & Davis, 2000) attempts to provide more explanatory power for the reasons behind an individual's perception of usefulness (or lack thereof) and comprises antecedents delineated across two categories: a) anchors – an individual's general beliefs about the system and its usage (e.g. self-efficacy), and b) adjustments – experiential-based beliefs resulting from use of the specific system in question (e.g. usability).

We tested a Technology Acceptance Model adopted from TAM2 (Figure 2), further expanded to include job relevance, which is defined as an individual's perception regarding the degree to which the system (AI in this case) is applicable to his or her job, i.e. what job tasks the system is capable is capable of supporting and the importance of these tasks (Venkatesh & Davis, 2000). While there has been a boom in the use of generative AI (or AI in general) due to the popularity of ChatGPT, it is unknown if TAE-relevant job tasks can be supported by the AI tools that are currently available out there in the market.

Sampling

The participants were recruited from participants of the TAE Landscape Study 2 conducted in 2022 by the Institute for Adult Learning (IAL), an institute that provides training and upskilling opportunities for adult educators in Singapore, as well as via a social media advertisement posted by IAL. Data was collected from November 2023 to December 2023.

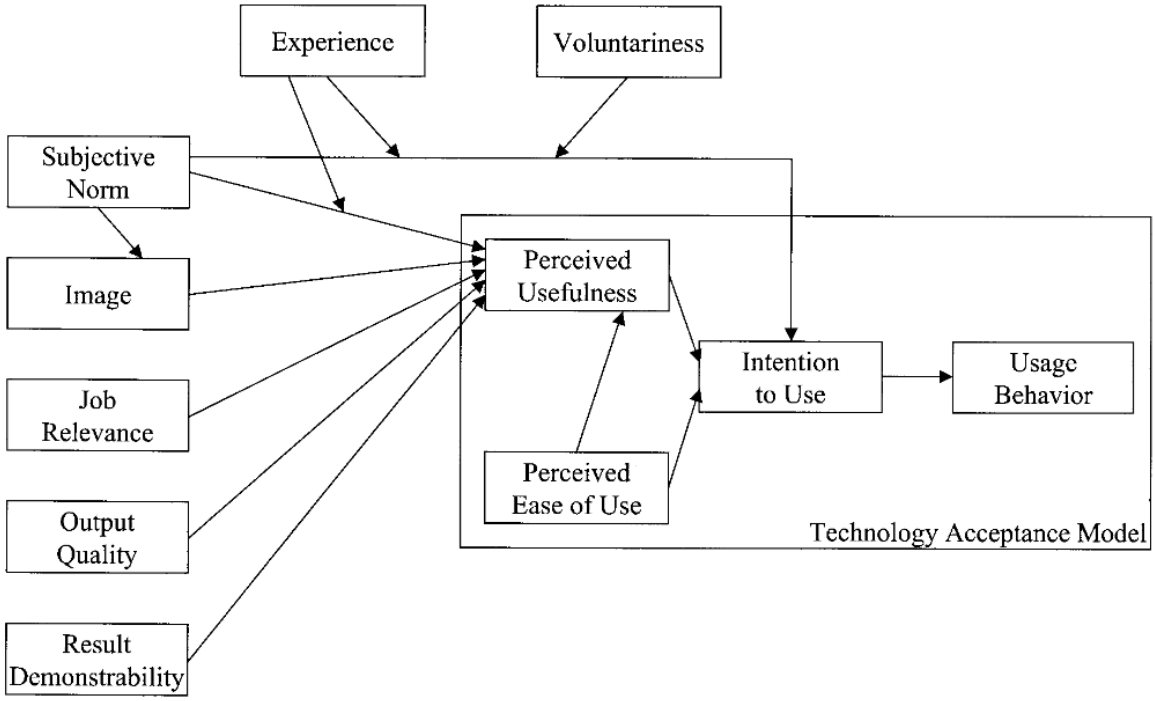

Figure 2 Extension of the Technology Acceptance Model (Venkatesh & Davis, 2000)

Results

Profile of Participants

A total of 624 AEs participated in the study. The demographic and employment information of these 624 individuals were presented in Table 1. The majority of the AEs sampled are 30 years old and above with at least a tertiary education. About a quarter come from private education institutes, and almost a quarter come from institutes of higher learning. About 1 in 3 are freelance AEs working for one or multiple training providers on ad-hoc or project basis.

	Proportion (%)
Gender	
Male	62.3
Female	37.7
Age (n=622; 2 with missing data)	
Below 30	4.3
30-39	24.0
40-49	31.8
50-59	26.2
60 and above	13.7
Highest Qualification	
Post-secondary and below	4.8
Diploma and professional qualification	11.2
Degree and post-graduate diploma/certificate	39.1
Masters and PhD	44.9
Type of training organization	
Private education institutes	26.1
Institutes of higher learning	23.1
Company training units	14.4
Business training consultancy	12.0
Public sector training institute	10.1

Others	4.3
Employment type	
Permanent employee	40.4
Freelancer	33.7
Others	25.9

Table 1 Breakdown of the 624 Adult Educators sampled in the online survey

AI Adoption

The AI adoption rate among the AEs in Singapore has doubled from 32.8% in 2022 (data taken from the TAE Landscape Study 2 conducted in 2022 by IAL) to 64.9% in 2023 (Figure 3). The proportion of AEs that frequently use AI in their work has also jumped from 5.4% in 2022 to 36.5% in 2023 (frequent use being defined as at least once a week in 2023). Most AEs (92.6%) who have used AI in their work, have also used GenAI (Figure 4).

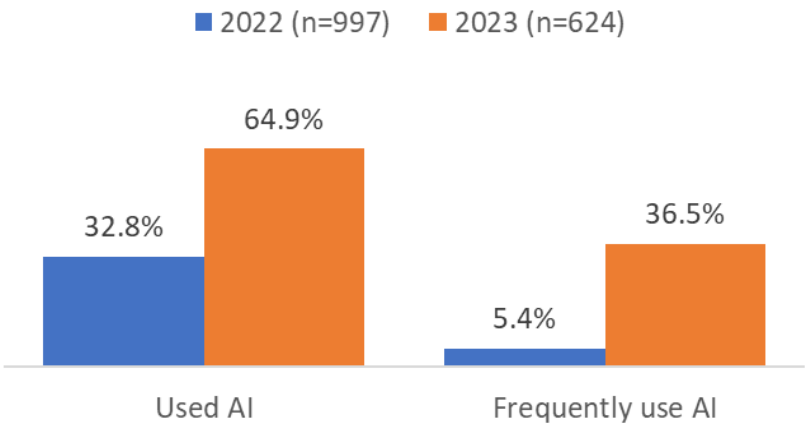

Figure 3 Adoption of AI among AEs from 2022 (n=997) to 2023 (n=624)

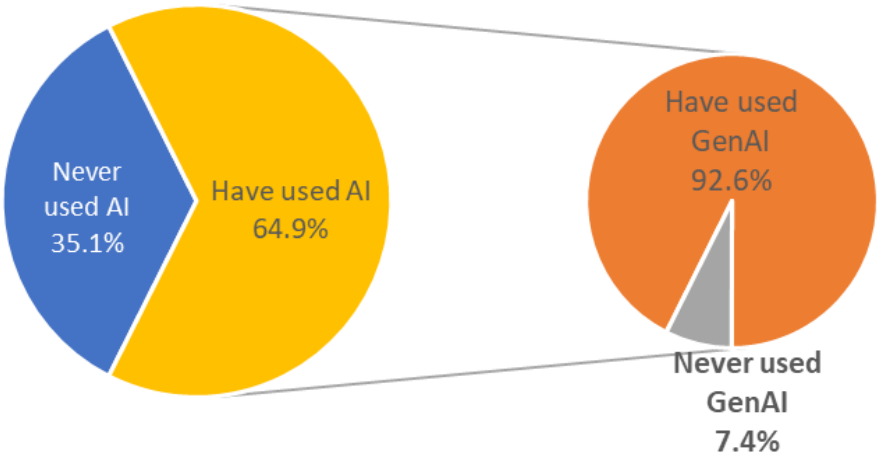

Figure 4 Use of AI among AEs in 2023 (n=624)

The predominant reason for AEs not using AI is due to the belief that they can do their current work effectively without any AI tool or technology, with about half of them with the sentiment (Figure 5). About one third of them also reflected that they were not familiar with any AI tool or technology. A small proportion of AEs feel that in the next 1 – 3 years, they are able to do their current work effectively without any AI tool or technology.

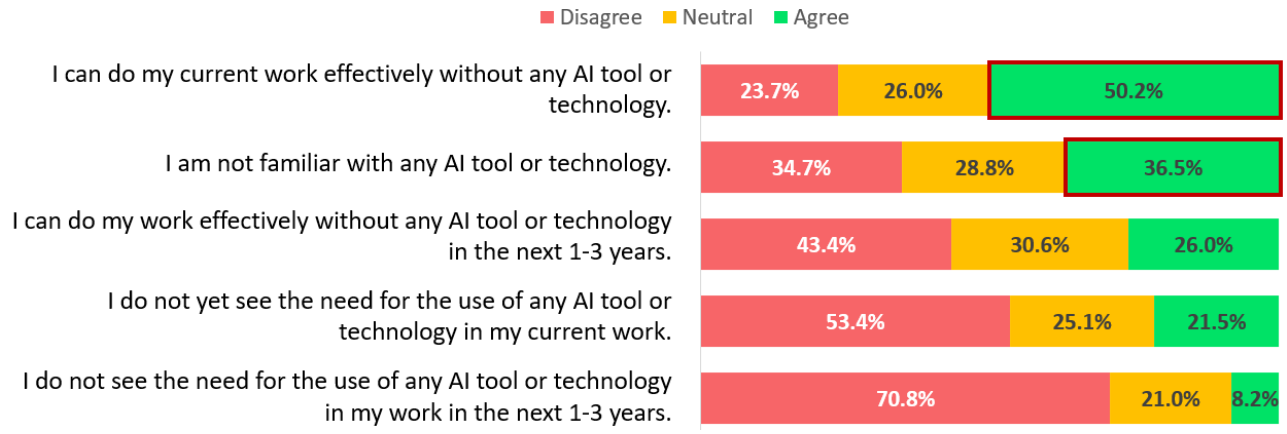

Figure 5 Reasons for not using AI for work

Perceptions of AI

On average, more than half of AEs have positive views on the use of AI in their work across all dimensions of TAM2, and feel confident about the use of AI (Figure 6). A significantly smaller proportion of AEs agree that AI is easy to use as compared to the other dimensions. Under the job relevance dimension, a significantly higher proportion of AEs agree that the use of is relevant to their work (77.2%), as opposed to being important to their work (59.9%).

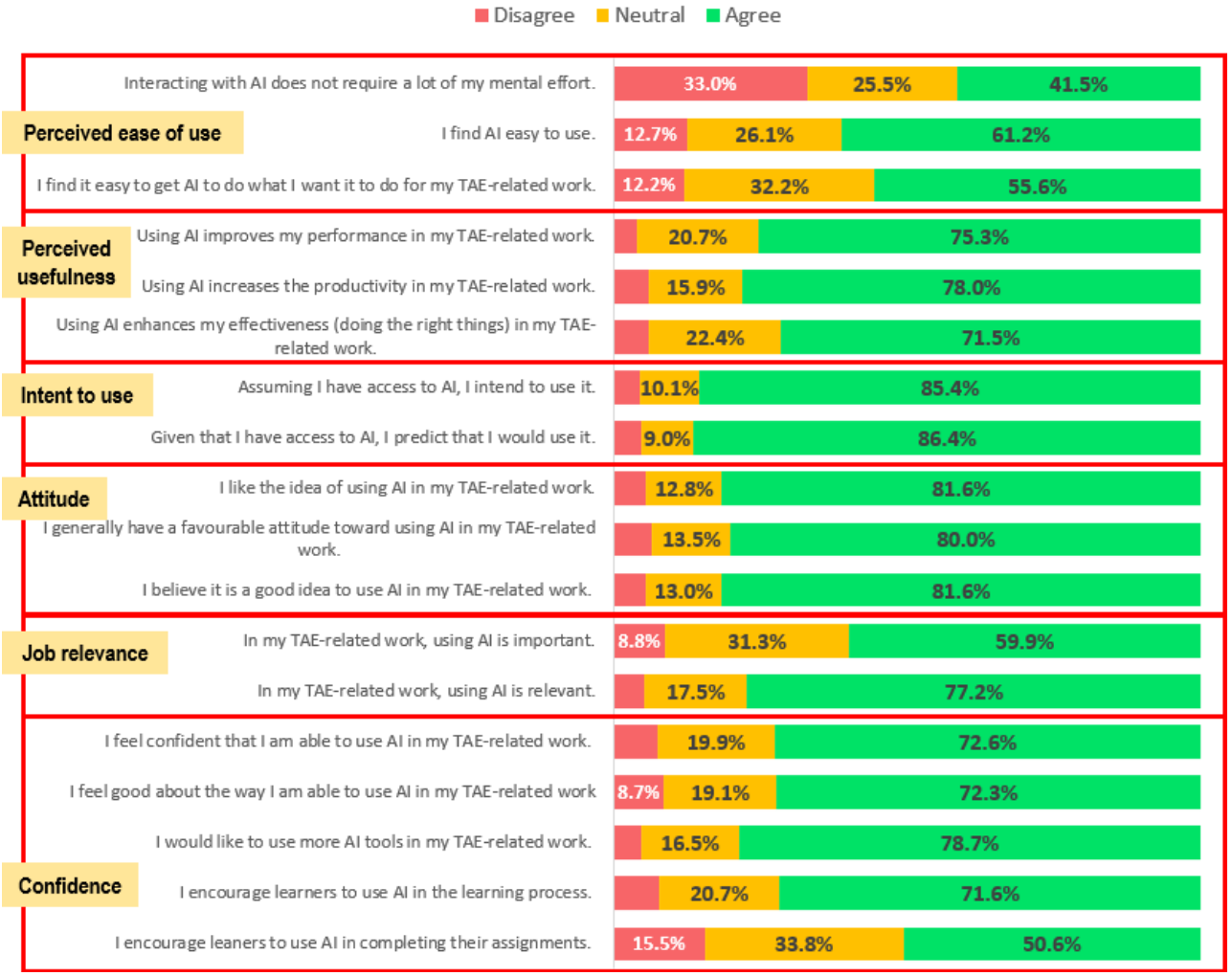

Figure 6 AE views on the use of AI in their work

As expected, AEs who have used AI in their work are more likely to have more favourable views on AI (Figure 7). Compared to AEs who have not adopted AI for TAE-related work, AEs who have

adopted AI are more likely to think that AI is easy to use, useful in enhancing their work, and relevant to their jobs; they are also more likely to feel confident in AI adoption. However, they do not differ significantly in terms of their attitudes towards the adoption of AI for their work, nor their intent to use it.

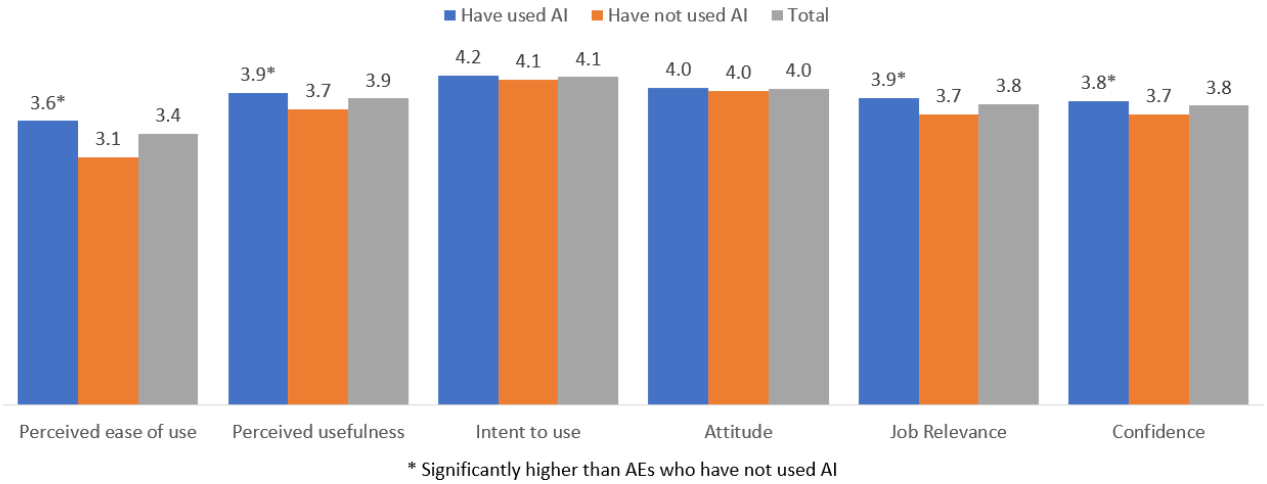

Figure 7 Comparison of AEs who have used AI versus AEs who have not used AI, views on the use of AI in their work

Technology Acceptance Model

Structural Equation Modelling (SEM) was conducted, and results of the proposed Technology Acceptance Model is illustrated in Figure 8. The proposed Technology Acceptance Model has a good fit (Table 2). As posited by TAM, perceived usefulness and perceived ease of use significantly and positively influence attitudes.

According to the TAM, perceived usefulness and perceived ease of use are the main determinants of adoption of a new technology (Davis, 1989). In this study, perceived usefulness refers to the extent that AEs believe that AI will enhance their work performance, thereby motivating them to use it. On the other hand, perceived ease of use is defined as AEs' beliefs that the use of AI is relatively easy in the context their work, and that the AI tool is user friendly. Our proposed model shows that perceived ease of use is a direct determinant of perceived usefulness (0.20). Venkatesh & Davis (2000) also highlighted that with lesser effort required to use a system, the increase in usage can lead to an increase in performance. There is also a direct and positive relationship between the relevance of AI to AEs' job with the perceived usefulness of AI (0.72) and perceived ease of use (0.52).

Attitude refers to the AEs' negative or positive feeling regarding the use of AI. TAM posited that attitude significantly influences an individual's behavioural intention to use, and our proposed model shows a strong relationship between the two measures (0.65).

There is also a direct and positive relationship between perceived usefulness and attitude (0.81) as well as perceived usefulness and intention to use AI (0.25). We have also observed a positive relationship between perceived ease of use and attitude (0.12).

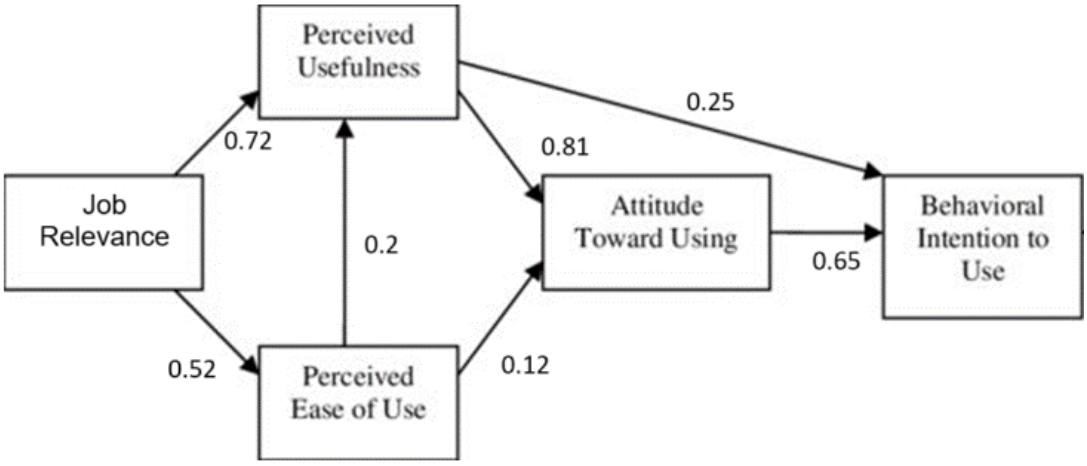

Figure 8 Proposed Technology Acceptance Model

Fit measures	Values	Recommended value
Chi square	162.77 (p=0.00)	p>0.05
RMSEA	0.054	<0.08
CFI	0.971	>0.90
TLI	0.961	>0.95
SRMR	0.040	<0.8

Table 2 Technology Acceptance Model Goodness-of-fit

Impact of AI

In order to increase the relevance to TAE-related work, it is important to understand how the current AI tools are supporting TAE-relevant job tasks, and how AI is impacting AE jobs.

About 7 in 10 AEs agreed that AI is essential for courseware development (76.8%) and curriculum design (74.7%), whilst less than 6 in 10 think that AI is essential for course delivery (54.2%) and summative assessment (57.7%).

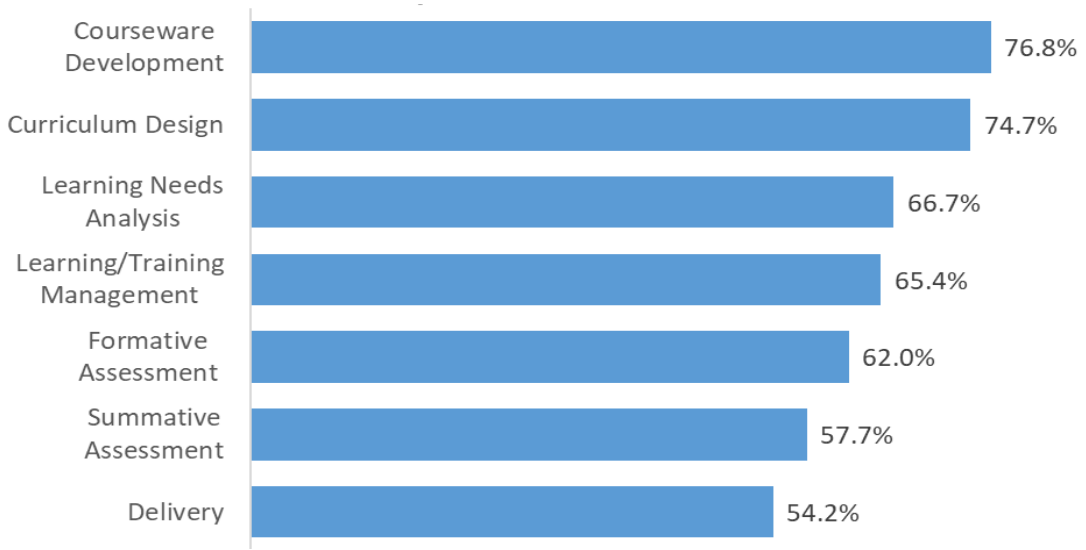

Figure 9 Importance of AI in performing TAE-related work

General views about the impact of AI on AE work seem to be positive (Figure 10). About half (49%) believe their work satisfaction will be or has increased, while 62% believe their overall productivity will be or has increased with the use of AI. About 2 in 5 AEs (39%) also believe the use of AI in their TAE work will or has decrease(d) their workload. Only about 1 in 10 AEs believe their work opportunities in the next 12 months (11%) or their income (9%) will decrease due to the use of AI tools.

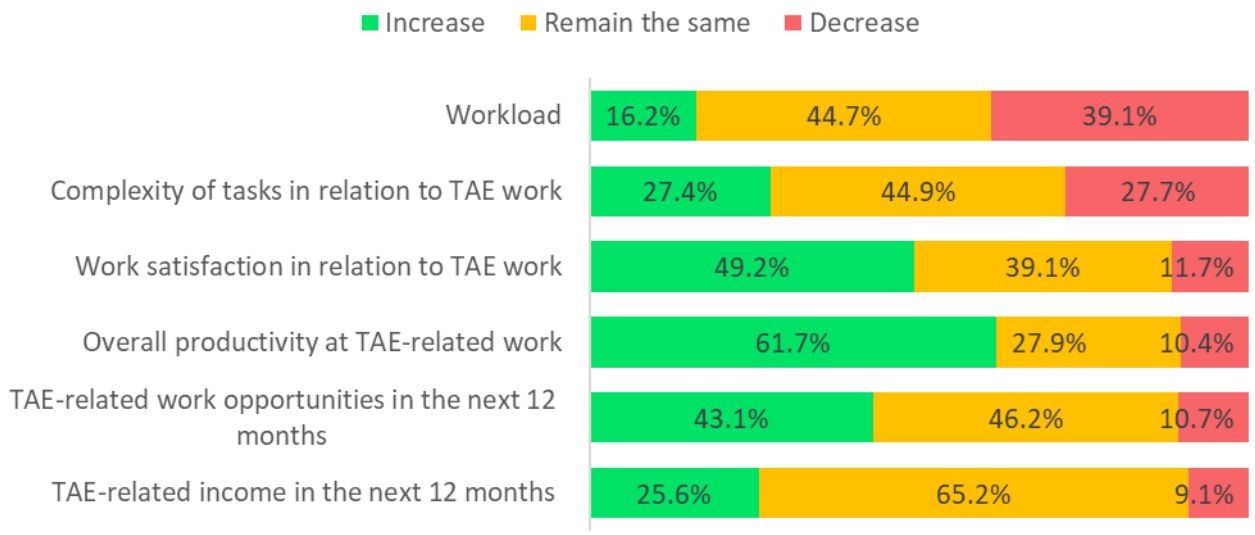

Figure 10 Impact of AI on AE work

Professional Development

As illustrated in the results of our proposed model, perceived ease of use significantly and positively influence perceived usefulness, which then significantly and positively influence attitudes towards the use of AI. Hence it is important for AEs to undergo professional development in the use of AI tools. About 1 in 3 AEs expressed that they have never received training in the use of AI tools for education and training purposes, while another third only went through basic training (Figure 11). Younger AEs are more likely to participate in training that are more advanced.

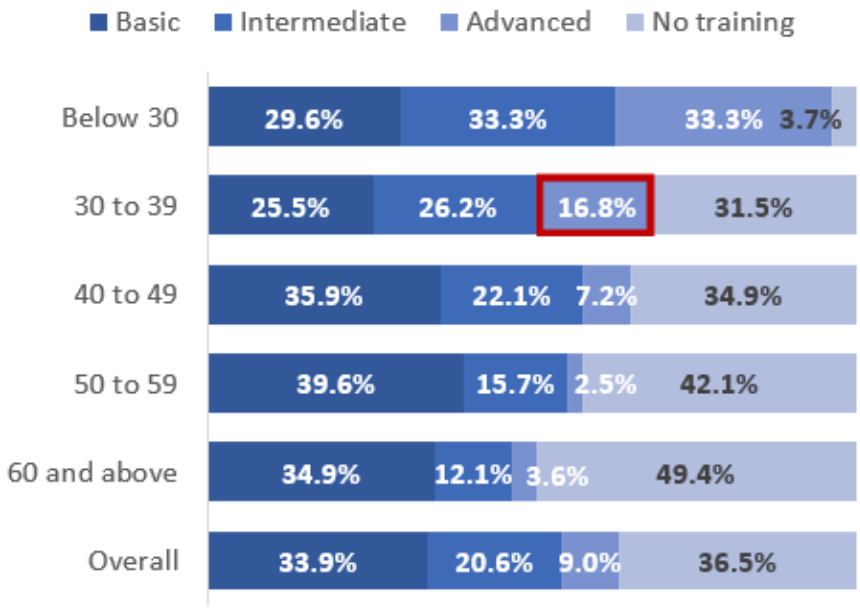

Figure 11 Training undertaken by AEs in the use of AI tools for education and training purposes

About 8 in 10 AEs have expressed a need training and professional development related to the use of AI tools for education and training purposes, and among these AEs, about 3 in 10 expressed that they needed such training within the next 1 to 6 months. Most AEs (61.7%) generally prefer training programs related in AI in education to last for 1 to 5 days, as opposed to shorter programs of only 3-5 hours duration (11.5%) or longer programs that takes 2 weeks or more to complete. When comparing participants by the highest level of training they have received pertaining to the use of AI in education, it appears that the preferred duration differs by the level of training. The preferred training duration for more advanced training is more inclined towards 2 week or more, while the preferred duration for basic training is more inclined towards 1 to 2 days (Figure 12).

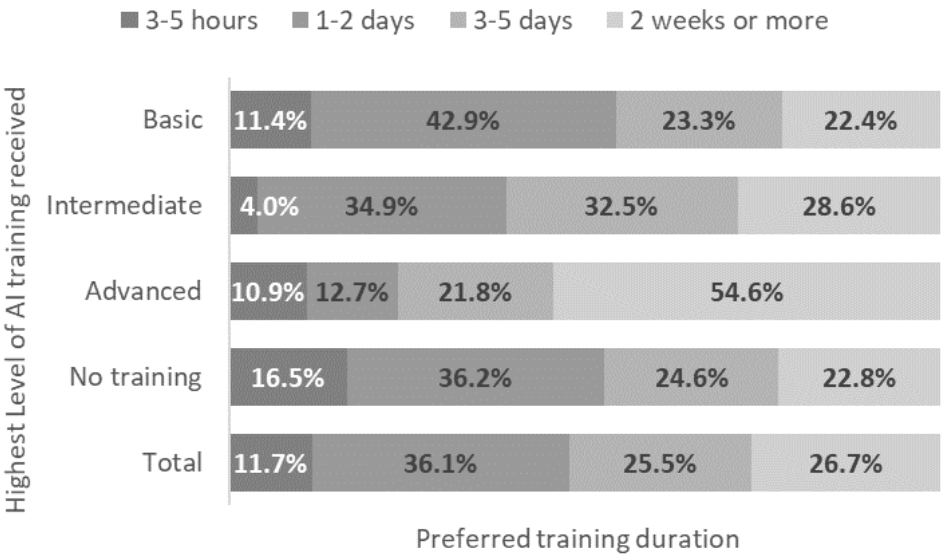

Figure 12 Preferred training duration, by the highest level of training received

Conclusion

Implications and Discussions

The findings from this study seems optimistic, with the AI adoption rate among AEs in Singapore doubling from 2022 to 2023, and more AEs using AI frequently for work related to TAE. AEs also generally have positive views pertaining to the use of AI in TAE and its impact on their work, regardless of their current adoption of AI for their work. Over 70% of AEs surveyed hold the view that AI is a valuable tool, enhancing their work performance, productivity, and overall effectiveness. Notably, around half of the respondents also believe that AI contributes to increased work satisfaction. These findings suggest that AEs not only recognize the practical benefits of AI but also appreciate its potential to improve their overall teaching experience.

However, a significantly smaller proportion of AEs agree that AI is easy to use as compared to the other dimensions of the TAM. A significantly lower proportion of AEs also agree that the use of AI is important as opposed to being relevant to their work. This is consistent with our finding that the main reason for not adopting AI in TAE is due to the belief that they can still do their current work effectively without any AI tool or technology. More needs to be learnt about the types of AI tools that are currently being used by AEs and the types of work tasks these tools support. An initial analysis of the top AI tools that the AEs have been using frequently for their work in the past 3 to 6 months indicate that about 14.6% does not have a clear idea of what constitutes an AI tool, and had mistakenly believed that email, AR/VR tools, and MOOC platforms are considered AI tools. To gather more in-depth information on AEs' experiences and their collective suggestions, a purposive sample was drawn from these survey participants to conduct follow up focus groups discussions. More insights can be drawn once triangulation with these data are completed in the next phase of this study.

This study offers a valuable springboard for understanding AI's role in adult education. While it sheds light on the Singaporean TAE landscape and the increasing adoption of AI within this sector, a more comprehensive picture requires a broader perspective. To address this, a collaborative research effort is underway, involving researchers from over 20 countries. This international study, commencing data collection in June 2024, aims to explore the usage and perception of AI in education and learning across diverse contexts.

Recommendations

While AI may have its benefits to an AE's work, it still has not become essential to them. In order to support AI adoption in the TAE sector so that its benefits may be reaped, we need to increase its relevance to TAE-related work, by increasing the demand for the use of AI as well as increasing opportunities for AEs to use AI in their work. Currently, the most prevalent use for AI in Education pertains to courseware development and curriculum design. It is possible to discover more possibilities of embedding the use of AI in the course of their work when AEs experiment more and share regularly with their peers.

To support this, there must be proper platforms or channels for AEs to share among themselves. One possible channel for this to happen are Communities of Practice. The Adult Education Network (AEN) is a "community of TAE professionals coming together to connect to opportunities, collaborate and learn for continuing professional development and skills acquisition" (IAL, 2024). Within the AEN, communities of practice called Special Interest Groups (SIGs) are held quarterly so that members can "acquire practical insights and exchange ideas in specific TAE functional areas with like-minded and established professionals" (IAL, 2024). It is possible for AEs to share their experiences as well as train each other in the use of AI for their work, under the Learning Technology SIG of the AEN.

Lastly, it is crucial to design AI tools to be user-friendly and easy to navigate, and to provide relevant technical support or trainings to AEs with low technological capabilities to familiarise with the use of AI tools in their work context. The resources can equip them with the necessary skills and confidence.

As illustrated in our results section, there is also demand for training related to AI in Education, with 30.6% requiring the training within the next 1 to 6 months. On average about a third of the AEs have not undergone any training in the use of AI tools for education and training purposes, and this proportion increases to more than 40% among those aged 50 to 59 and almost half among those aged 60 and above. There needs to be not only supply of such training to these AEs (particularly the more mature ones), but also support and encouragement from their employers to attend such training; the ideal training duration for such training are recommended to be 1 to 5 days. There also should be progression for the AEs to gain more advanced training after they have gain some introductory knowledge about AI either from their peers via the SIGs, or via structured training.

In terms of the design of AI tools, the ease of use of the tool is an important determinant as shown in our findings. Therefore, the AI tool that is adopted by training providers should be user-friendly, as well as facilitate and enhance the work of the AEs. Some support should also be provided during the adoption of new AI technology, especially to AEs with lower technological capability, in order to learn how to navigate and use the various functions of the tool. These supports would ease the anxieties of AEs having difficulties with AI adoption and allow them to enjoy the benefits of AI technology.

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